THE EXCHANGE

AN ELECTRICAL REBUILDER'S ASSOCIATION PUBLICATION

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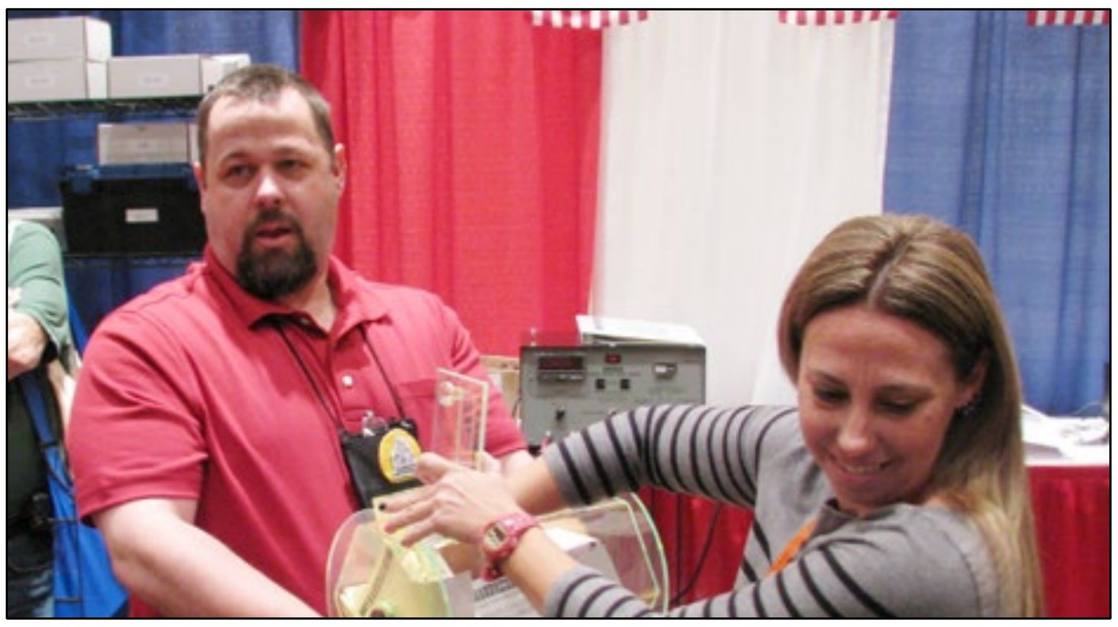
"And the lucky winner is ..."



Scott Scharrer (JIMCO) holds the raffle drum as Cassandra Clausman (Unlimited Packaging & Supplies) draws the winning entry for the JIMCO TB770 test bench.



John Kaiser accepts the TB770 test bench on behalf of the Ryder Rebuild Center and is congratulated by Scott Scharrer (JIMCO)

Atlanta Show Receives An A+

BY ERE STAFF

The ERA Expo in Atlanta March 21-23 was one of the best attended shows in recent years. In total, 174 rebuilders travelled to the show from 32 different states, four Canadian provinces, Guam and Bermuda. Most rebuilders said that they came for the seminars, with 139 signing up for them. Vendors liked the increase in attendance. The most often heard complaint was that there was not enough free time.

The three-day event began on Friday morning with a panel discussion on customer relations, conducted by ERA members Mike Dietrich, Ronnie Charnes and Lynn Gross. Immediately following that presentation, two buses and a small caravan of personal vehicles carried 130 attendees to Boles Parts Supply for a tour of their core-handling facility and rewinding operation (housed in separate buildings.) After the tour, BPS provided a lunch for everyone, including the bus drivers. Owner Jerry Boles personally led the tour, with

(See SHOW, pg. 5)

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Paris Rhone A13M14
Rewinding simple stators

BY BOB THOMAS

Not many rebuilders are likely to see a Paris Rhone A13M14 alternator (*see Figures 1 and 2*), which is used on Allis Chalmers 6040 farm tractors. According to Tractor Data, from 1974 to 1975, only 499 of these tractors, with Perkins engines, were manufactured in France by Renault. Many of these tractors were sold in North America.

This particular alternator is quite different from what you would expect to find, and it is worthy of its own article. However, as the headline suggests, the real topic here is rewinding this stator. Unlike most other alternators, this Paris Rhone unit is two-phase, not three-phrase. If you look at the JIMCO diagram (*see Figure 3*), you can see that the two stator coils are wound in parallel. One end of each of the two coils is connected to a separate negative diode. The other ends of the two coils are connected together at a single positive isolation diode, which separates the battery from the source of the field current.

The field current is taken from the positive end of the stator coils, before the output current passes through the isolation diode (as shown on the JIMCO diagram). On the tractor, the external B-circuit regulator is excited by the charge-indicator lamp.

When this alternator was brought into my shop, the stator coils were loose and shorted, both internally and to ground. An estimate for rebuilding it was based on having the stator rewound. The owner had found a used alternator online at a tractor salvage yard. The used alternator was inexpensive, but it was sold "as is" with no guarantee that it was good. As it turned out, the stator in the salvage-yard alternator was in the same condition as the customer's original. So we decided to try to rewind one of the bad stators. The slots in this particular stator are wide, and the poles are similar to what you would see in many small-engine charging systems, making it relatively easy to rewind by hand.

Rewinding The Stator

Rule one—*The wire gauge must be correct.*

The first and most important step in any stator-rewinding project is documenting the original. You can do this by drawing a diagram of the stator, noting the position of the leads in relation to the location of the through bolts. (It may also be helpful to take several "cell-phone" pictures of the unit along the way as you disassemble it.) Then, use a torch to burn the insulation coating off of the stator wires and burn

(See STATOR, pg. 10)

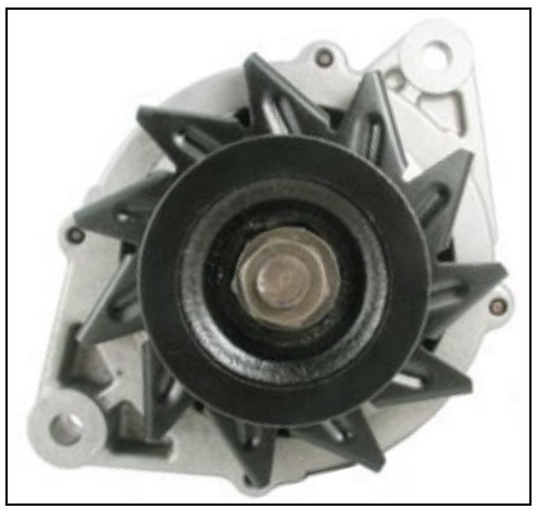

Figure 1—Paris Rhone A13M14 alternator for 1974-75 Allis Chalmers 6040 farm tractor.



Figure 2—Rear view shows single positive isolation diode (top-right) and the two-diode negative rectifier (bottom-left).

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THE EXCHANGE

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Serving the automotive electrical aftermarket

SINCE • 1983

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Trade Secrets
Time for change

BY BOB THOMAS

Although keeping up with new technology is certainly a huge challenge in the rebuilding industry today, there are no longer any "trade secrets" in this business. By trade secrets, I am referring to those techniques and short cuts (many discovered through trial and error) that we all use everyday during the rebuilding process.



At one time, competing rebuilding businesses never considered sharing anything they knew with one another, for fear of helping their competition.

When I opened my business in 1980, there were over 30 electrical rebuilding businesses in this northeastern corner of Florida that covers four counties. Several of them had been open since the 1940s, and most of the others were owned and operated by relatives or former employees of one of that original group. Together, they bought nearly four pages of display advertising in the Jacksonville phone book every single year—each trying to out-do the others. In those days, there was fierce price competition between those businesses, and few rebuilders shared their information with any others—even their relatives! I was lucky enough to already know two small shop owners when I opened my business. They both unselfishly helped me when I started out, and as I gained experience, I was able to return their favors. But that was an exception to the norm back then. Perhaps I was just lucky to know those two guys, or maybe we were ahead of our time.

Suppliers like Ace Electric and later WAI, tried to educate their customers and the industry by holding seminars from the 1970s to the 1990s. That was where many of those trade secrets were shared by instructors like Bob Goulding, Joe Davis and Ray McCollum. The Automotive Parts Rebuilders Association conducted weekend electrical clinics several times a year at various locations around the US and Canada. Those events provided many opportunities for rebuilders to share information with each other. There were seminars and panel discussions, where industry veterans like Richard Vensel, Mohammad Samii, Dan Smith, Alan Melton and many others, willingly shared their experience and knowledge with anyone who took the time to show up. Sadly, those events were well-attended only when someone else footed the bill, and a free meal was involved.

The advent of the Internet has provided a platform for emails and has spawned online forums, where people in the rebuilding industry could easily help one another, without leaving their homes or businesses. Requests for help with a problem, now are almost always answered within hours, if not minutes. Both kinds of computer communication are being used today by many rebuilders who are willing to share what they have learned—their trade secrets.

This monthly newspaper was conceived over thirty years ago, because someone believed it would benefit our industry—its sole purpose,

(See SECRETS, pg. 15)

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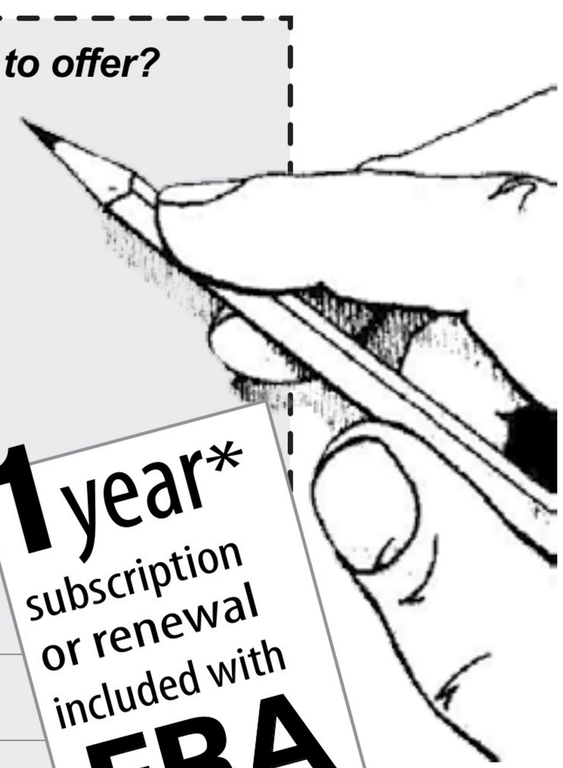

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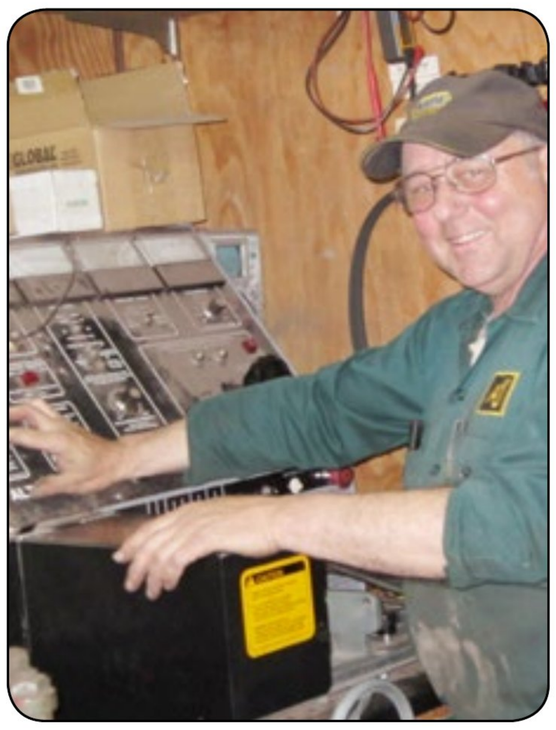

"I was overwhelmed by the wealth of information ..."

Alan Reynolds
A&J Transport
Halcott Center, N.Y.

"I found a flyer for a trade show in a box of parts from a supplier, advertising the 2005 ERA trade show in Atlantic City. I'd never heard of the ERA and didn't even know there was a trade newspaper. The rebuilder who sold me the business had advised me to stay away from trade associations. He said they would only take my money and were only out for themselves. But I saw all the seminars on the flyer and thought I might learn something. I was overwhelmed by the wealth of information I found at the trade show and those seminars. I saw and heard so many things I never knew existed. I quickly realized that the rebuilder who sold me the business was wrong! It was an easy decision to join the ERA."

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From The President's Desk
Doing The Impossible

COLUMN BY HANK HENKE



Writing this column is the hardest thing I have to do each month. For those of you who know me, you may think that I am never at a loss for something to say. One-on-one and face-to-face, or even speaking in front of a group, isn't as hard for me as writing this column. It seems that I can never think of a topic that might be of interest to our readers and members.

Maybe I should tell you about the customer that didn't have a clue on how to test ... No, we all have them, and we all have the same stories to tell ... I know … How about the rebuilder in the next town who always wants to under sell me? No, we all have those stories, too ... I know … what about the lack of American-made parts? Heard that before? What about our vendors selling to our customers? That is old news as well. With all of those problems facing us, it is no wonder that some believe that our industry is dying. I keep hearing that rebuilders are a dying breed.

Why fix something or re-manufacture something, when you can buy a new one at a lower price? Nobody cares about how well it is made or how long it will last, as long as they get a piece of paper with it that says it has been computer-tested. Americans are really good at throwing away old or outdated things, even when the old technology may have been more durable or performed better than the new product that is replacing it. I live in a small farming town, and it looks like a lot of those old Fords and Chevys are still around and running after 30 years of mud, crud and dirt being caked on. Is anyone going to keep a Prius for 30 years?

I love being able to take something apart, figure out what is wrong with it, fix it, hand it back to my customer and tell him that it should last another 20 years. New stuff just doesn't seem to last. New products using the latest technology, appear to be built so that they will break or fail faster and faster. (Some conspiracists call this "planned obsolescence".)

Doesn't it make sense to fix something rather than just replace it? My grandson Trevor really enjoys making his in-laws look on with shock when he brings a small AC motor back to life with only some oil and an air gun. He repaired a Sawzall® that he rescued from the scrap heap for a whopping 15 dollars worth of parts. That seems much more reasonable than having to buy a new saw does it not?

Rebuilders are setting themselves up to fail when they just want to buy "brand new" rather than rebuild what they can. I looked back at one of my old articles (from the July 2011 Exchange) entitled "Never Too Old To Learn." The essence of the article is that you never know where your next dollar will come from. Money can come from working on just about anything. Sometimes we end up repairing different types of electrical equipment other than our regular alternators or starters, because we hear the desperation in a customer's voice when he says, "I have looked everywhere, and I cannot find anything that will replace this unit!" If we take in that job, we may have to spend a lot of time looking up parts ... doing a lot of research ... and looking up more parts ... to finally make this unit work! But the satisfaction of "doing the impossible" is more than worth the effort. When a customer tells me, "So-and-so told me that this could not be repaired," I take that as a challenge!

Word of mouth travels faster than the Internet when you surprise a customer by doing what he believed was impossible. Soon you have a whole group of his friends bringing you motors, winches and other gadgets. That just has to put smile on your face!

Hank Henke, ERA president, is owner of United Starter & Alternator, Lowell, Ind.

E R A

Locking Compound Update

BY THE EXCHANGE STAFF

A few issues back, we published an article on locking compounds, but we omitted one product that can be used to secure bearings in housings that do not have fastened retainers (specifically Delco CS and AD series alternators). It was brought to our attention that Inter-Lock 42, from International Epoxies, can be used to secure bearings. This product is both a medium-strength threadlocker and an adhesive sealant. It is available from Vensel Enterprises.

We tested Inter-Lock 42 using a 6303 bearing and a CS130D DE (drive end) housing. After allowing the recommended cure time of 24 hours, we had to apply over 500 pounds of pressure before the bearing moved. We determined that this product will work, as long as the bearing cavity of the housing is not worn. If the bearing is a loose slip-fit in a worn housing, one of the previously recommended locking compounds would be a better choice.

E R A



Inter-Lock 42

Plain Talk
The status quo won't get it done!

BY ROB BUKSAR



I've been living in the same geography for a long time. The changes that have occurred continue to make my head spin, even though I've watched it all happen.

I grew up in an area that was the dictionary definition of "commercial." Everything was available from soup to nuts. Most of it was sold, distributed, repaired or maintained by individually-owned companies. Some of them were going on their 3rd generation. Now, most of it is gone and has been replaced by giant corporations and their outlets. We pretty much can thank Ronald Reagan's deregulation for all of the above. You see, those regulations kept the "big" from devouring the "small" and pretty much kept the domestic playing field level.

There are those who think President Reagan should be nominated for sainthood. Then, there are those who have a contrary opinion. You make your own call.

This is no revelation, but the deregulation has turned a once orderly economy into a mass feeding frenzy! Old news, right? Wes's (The Exchange's production manager) wife did a cartoon a few issues back, and I got the biggest kick out of it. She displayed a rebuilding shop selling soft-serve ice cream along with their rebuilts. If my memory is still working, I think the cartoon's byline was, "Whatever works!"

Going up and down the streets of America's marketplaces—they sure ain't what they used to be. It was once somewhat orderly and sensible. Now, it's "anything goes!" It seems that those who have the financial ability, will stock any unrelated item that they think has a chance of selling, in hopes of selling it. The problem is, we now have a whole lot of sellers, selling things that they know little if anything about, or are willing to take responsibility for. Further, since service and experience used to have a great deal to do with who you dealt with, when there is little if any expertise in the marketplace, price is all that determines who's going to get the business (at least in most cases). That's something, isn't it! A big market place where many know very little about a whole lot!

Some of you out there have a lot more opportunity than others, due to the market you're in. Don't be afraid of the opportunity, because it might initially require money and work. None of us are youngsters anymore, and the very thought of this would unsettle someone 20 years younger. Nevertheless, our once dedicated market will continue to split and divide, leaving less for the dedicated rebuilder.

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Our current political system, educational systems and corporate America are no longer interested in building our homeland. From the classroom to the board room to the halls of power, all that's being discussed any longer is the global supply chain and global economic system.

So, to the remnant of American individual owner-operators, the American rebuilders, you have to be pro-active in order to strengthen and preserve yourself.

I've been recently enlightened concerning my own shortfalls. Some, with help, I can act upon ... some not. Either way, the status quo won't get it done. To remain the same in this environment is like standing on a small piece of ice floating around in a hot lake!

For those who were able to attend the ERA show, I hope it went well for you. Training and networking is what it's all about. I hope those that attended took maximum advantage of what was there. Keep in mind, it takes only one little idea to turn the tide in any situation.

May God strengthen and preserve our little industry.

Rob Buksar is owner of Hoosier Electric Co., Gary, Ind.

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SHOW

(Continued from page 1)

people from every department scattered among the group to answer questions along the way. The tour was a classic example of true southern hospitality.

The BPS tour was followed closely by two more seminars. Joe Davis shared what he has learned since he retired. He included his experiences in the field of rebuilding, in business and in life. Then Marshal Townsend explained flash-reprogramming of automotive electronics.

The reception that followed outside the exposition hall was a little different from past years. Usually, hot canapes had always been served. This year, the reception featured a Chicago-style pizza buffet and cash bar. " We would like to thank JIMCO, IMI Performance Products, WAI-Global, Wagner Alternators and Supplies, International Automotive Trading, Arrowhead Electrical, Boles Parts Supply and Letrika USA, for making the reception possible," explained Wes Grueninger, who managed the show for the ERA. "Without their generous support, we could not have done this."

The exposition was opened for three hours on Friday evening after the reception, and the show floor was very busy the whole time. Later, Shawn Bray of Romaine Electric, closed out the long day of events with a seminar on pricing rebuilt products for individual markets.

Saturday morning started early at 7 a.m. with a seminar on battery technologies by Dan Bell of Whatcom Electric and Apptrak Online. Then, Gene Kaiser and Dave Kaplan of Regitar USA, explained COM-terminal charging systems, how they differ between vehicle manufacturers and how rebuilders can test them. John Kaiser of the Ryder Rebuilding Center, just outside Atlanta, presented a seminar on rebuilding the 39MT starter.

The exposition opened again following the morning seminars and remained open until 4 p.m. with drawings for door prizes and raffles filling the final hours. The big prize was the JIMCO TB-770 test bench, won by Laura Curtis of the Ryder Rebuild Center, Doraville, GA, and accepted for her by John Kaiser, also of Ryder Rebuild Center. Lynn Gross, of Churubusco Auto Electric, won the ERA raffle for a Transpo VRC2010 voltage regulator tester, donated by WAI-Global. Leroy Smith, of Leroy's Generators and Starters, won the consolation prize in the raffle, a new 32" LED TV, that was field-tested over the weekend showing training videos in the ERA booth. Glen McLaughlin, of Alternator-Starter Service, won a T-1800C COM-Regulator Tester in the drawing at the Wagner Alternators & Supplies booth. Regitar USA gave away several prizes: an air impact gun, won by Randy Bennerotte, of ASAP; a 1/2-inch drive battery-powered rechargeable impact driver, won by Lawrence Limtiaco, of Guam Electric Motor Services and an AC Delco inspection camera, won by Daren Roggentien, of Roggentien Electric. These products are all manufactured by Regitar USA. Level Seven gave away a Dell tablet, won by Gail Turner of C. C. Battery. WAI-Global awarded $50 gift cards to three lucky winners: Brenda Anderson, of Starline Rebuilders; Kane McGarity, of McGarity Starter and Alternator Repair; Chris Tompkins, of Proline Distributors.

When the show floor closed down, the seminars resumed. Mohammad Samii's seminar was sponsored by the Automotive Parts Remanufacturers Association. He graciously tailored his seminar to fill in the information gaps between the subjects covered by the others speakers. Samii's talk included solutions and answers to many common problems that rebuilders encounter. That was followed by a Rebuilder's Roundtable Forum, moderated by Dan Smith of Arrowhead Electrical Products and Alan Melton of AMFOR Electronics. As always, there was a lot of rebuilder participation, with many questions asked and answered by the audience.

Sunday morning, the ERA held their annual meeting and breakfast, open to all ERA members who registered for it. 65 members in all signed up. Reports were given, and new officers were elected to fill expiring terms. Mike Schroeder became the new treasurer, while Larry Hagemeister rejoined the executive board as second vice-president, filling the unexpired term left by Schroeder. Ken Plourde was re-elected as first vice-president on the executive board. Jerry Kieffer re-joined the board of directors as the NW vice president. Alan Reynolds, Mike Dietrich and Bill Skillings were all re-elected as regional vice presidents. Lynn Gross, Gene Kaiser, Scott Scharrer and John Brillman all joined the board of advisors. Although he was not able to be present, Chris Thompson, who had served as ERA treasurer for 11 consecutive years, was made a lifetime honorary ERA member. ERA president, Hank Henke, read the words on the plaque which was created to honor Thompson.

Dan Marinucci flew into Atlanta very late on Saturday evening, following an all-day seminar which he had just given in Harrisburg, PA. With minimal rest, he managed to squeeze a four-hour seminar into the three-hour time slot following the ERA annual meeting. In his seminar, Marinucci covered testing Ford and GM charging systems controlled by the PCM. He explained multiple ways to isolate the causes of charging problems on these vehicles.

Here are some of the things that rebuilders had to say about the ERA Expo 2014:

"This is the first ERA EXPO I have attended and was very impressed and very happy I made the decision to spend the money to go. I'm sure I will be back.

(See SHOW, pg. 12)

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Lucas M50–M127
Setting pinion clearance

BY BOB THOMAS

Pinion clearance is probably one of the least understood calibrations required in rebuilding starters. It is critical to the proper operation of Lucas M50 and M127 starters. These starters in particular, are the most difficult in which to set the precise clearance.

The definition of pinion clearance is: the measurement between the leading edge of the pinion gear and the trailing edge of the stop collar (*see Figure 1*). In the event that there is no stop collar, it is the measurement between the pinion and the DE (drive end) housing, as in this 41MT Delco starter (*see Figure 2*). This measurement must be taken with the drive in the **engaged position**. The safest way to fully engage the drive to check pinion clearance, is to run power through the solenoid's pull-in coil only, just long enough to take a measurement. **To power the pull-in coil, ground the motor terminal and apply power to the switch terminal** (*see Figure 3*).

In the case of these two Lucas starters mentioned earlier, the pinion clearance is .015" to .025". That window is only 1/100th of an inch from one end to the other, or about the thickness of a standard business card. Both the M50 and M127 starters use a non-concentric shift lever pin (*see Figures 4 and 5*) with threads on one end. This pin screws into the DE housing. Rotating the pin with a screwdriver moves the pivot point of the shift lever to adjust drive travel on the armature shaft. Half-a-turn, 180 degrees of rotation, is all that it takes to move the pinion about ¼ of an inch, making it extremely difficult to get it within the 1/100th of an inch window which is "just right". A jam nut (*see Figure 6*) holds the pin in place after the proper adjustment has been achieved.

When assembling one of these starters, turn the shift-lever screw all of the way in until it bottoms out, but do not tighten it. Do the same with the jam nut. You will back the screw out during the adjustment process and then will tighten the jam nut, once you have completed the adjustment.

A wire gauge (*see Figure 7*) can be used to measure pinion clearance. But in this case, we use a feeler gauge (*see Figure 8*), because we believe it is easier to judge exact clearances. Once the pinion is fully engaged, lightly push the pinion away from the stop collar to remove any slack and measure the gap. When you adjust clearance with a feeler gauge, slide the gauge between the pinion and the stop collar, as you close the gap by turning the threaded pin. When you reach the correct adjustment, in this case .020", you will "feel" resistance in the movement of the gauge (*see Figure 9*). Be careful not to put power to the solenoid for more than a few seconds at a time. The solenoid will warm up

(See PINION, pg. 11)

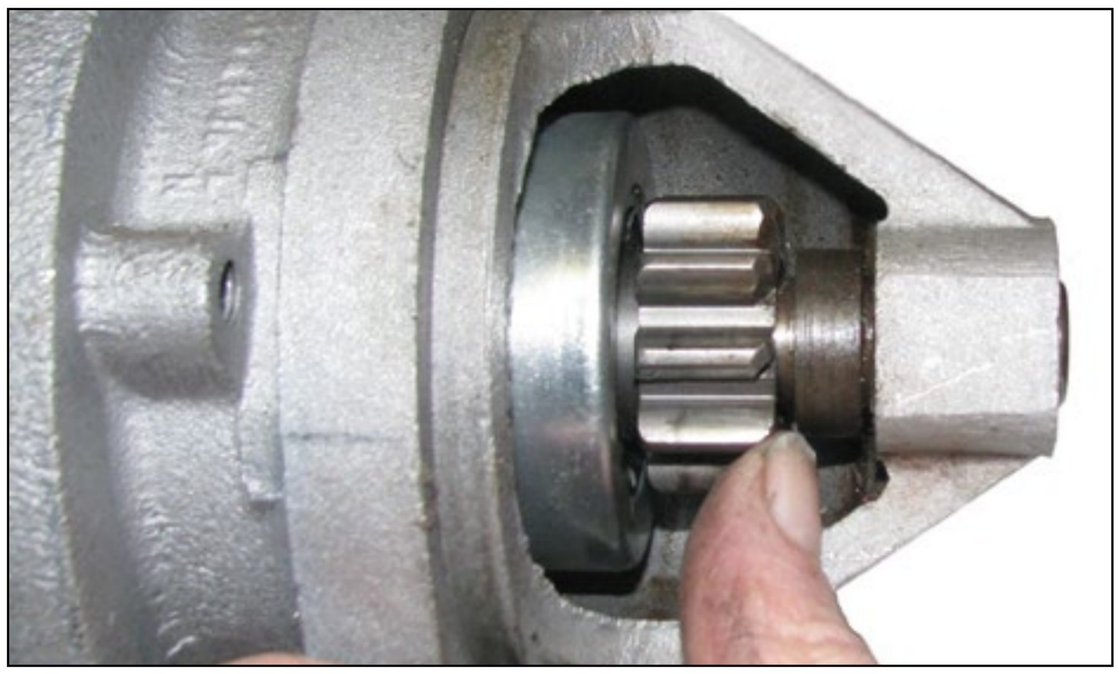

Figure 1—Pinion clearance is measured from the leading edge of the pinion gear to the trailing edge of the stop collar. It is sometimes called air gap.

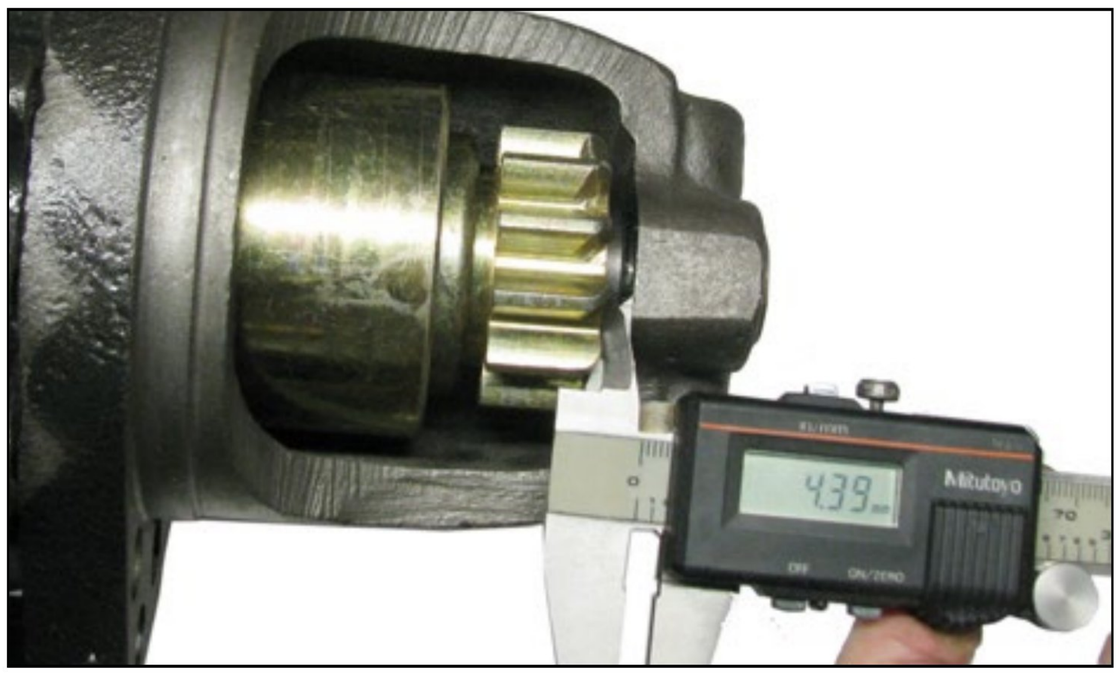

Figure 2—Pinion clearance being measured on 41MT starter which has no stop collar.

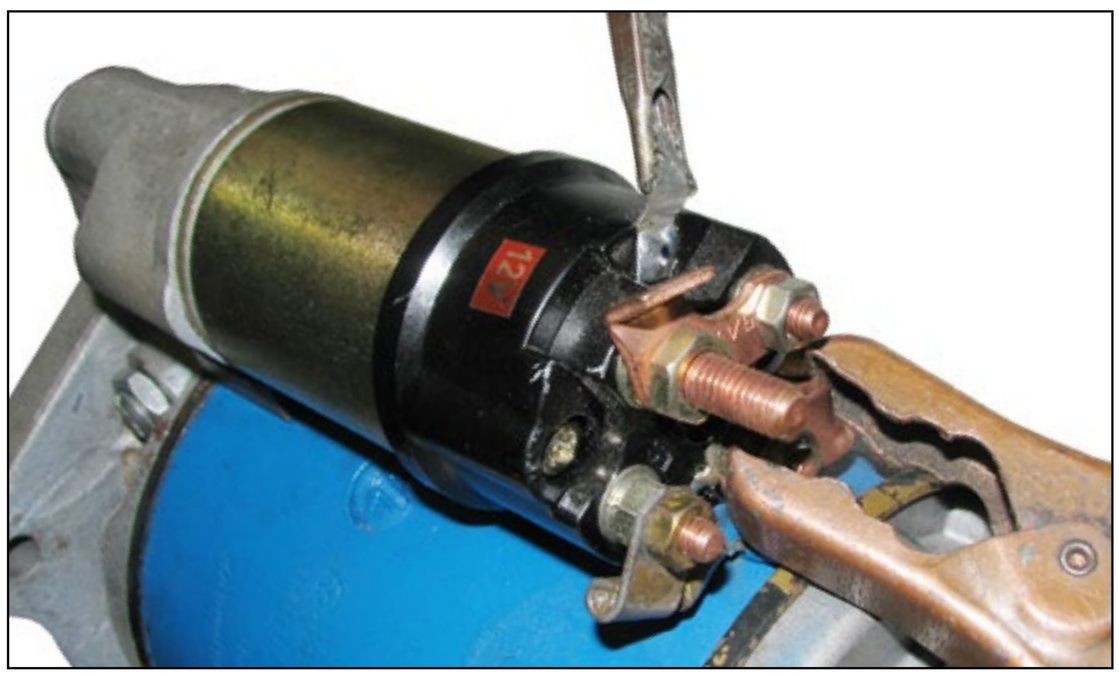

Figure 3—Ground the motor terminal of the solenoid and apply power to the switch terminal to engage drive and measure pinion clearance.

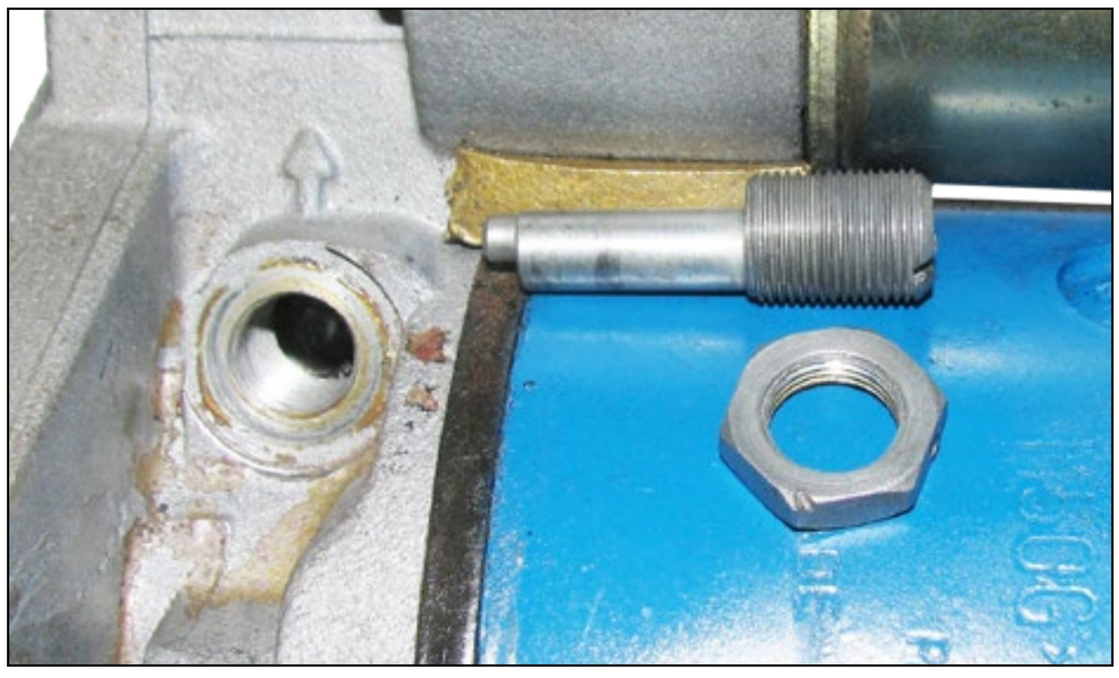

Figure 4—Jam nut and shift lever pin removed.

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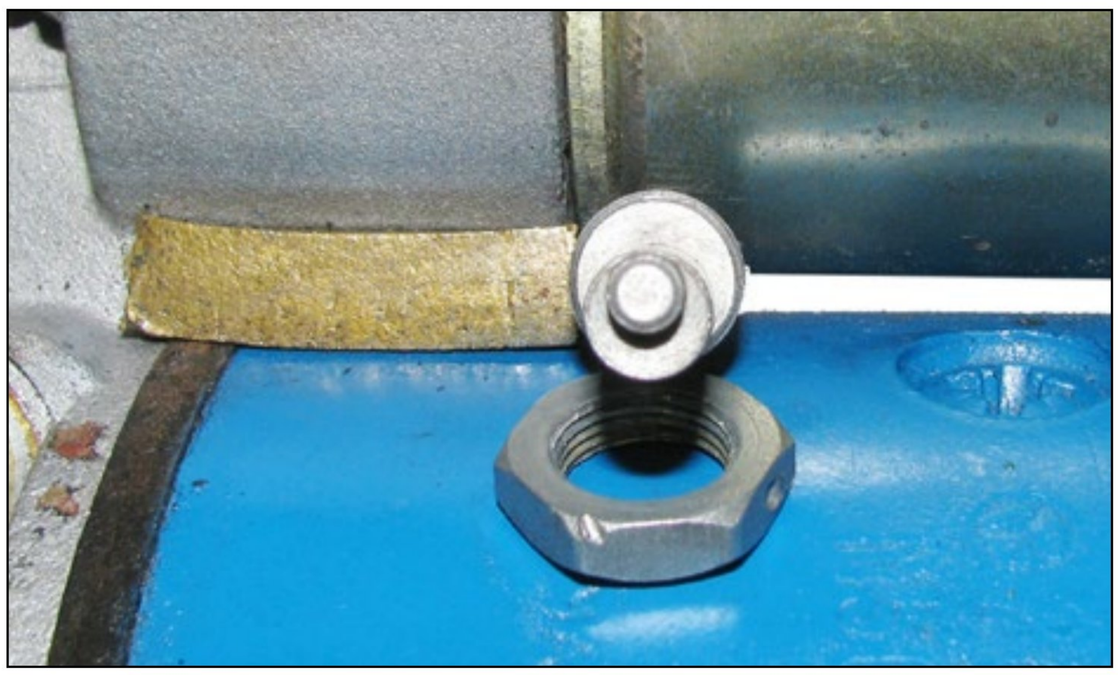

Figure 5—The shift lever pivots on the non-concentric part of the shift lever pin.

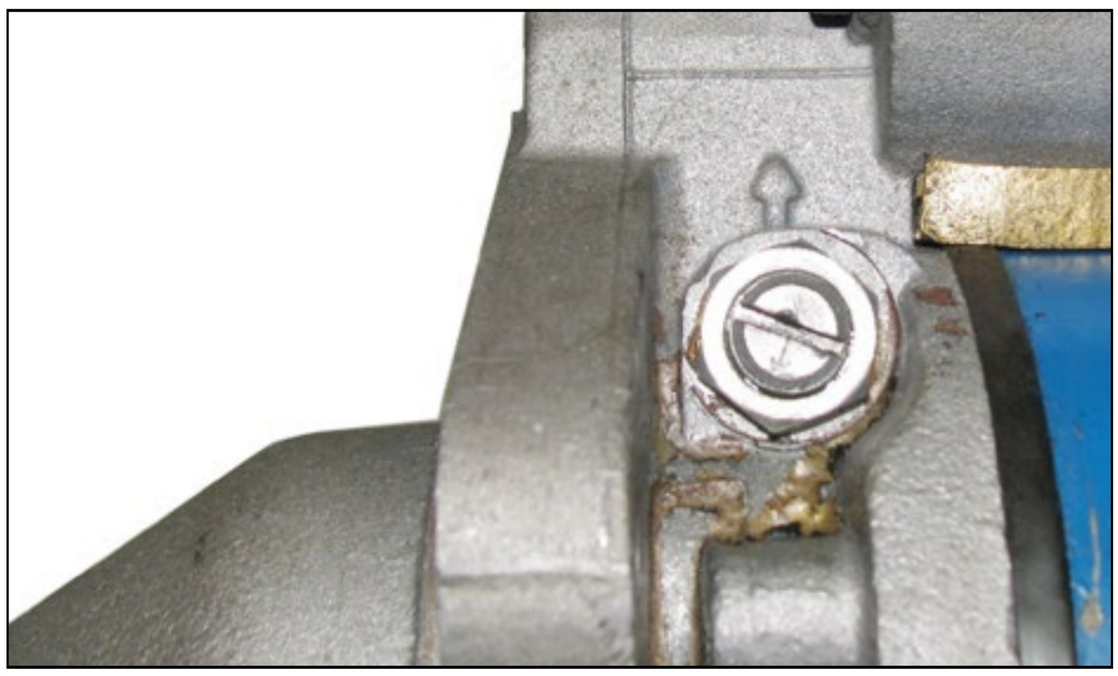

Figure 6—Shift lever pin and jam nut in place ready for adjustment.

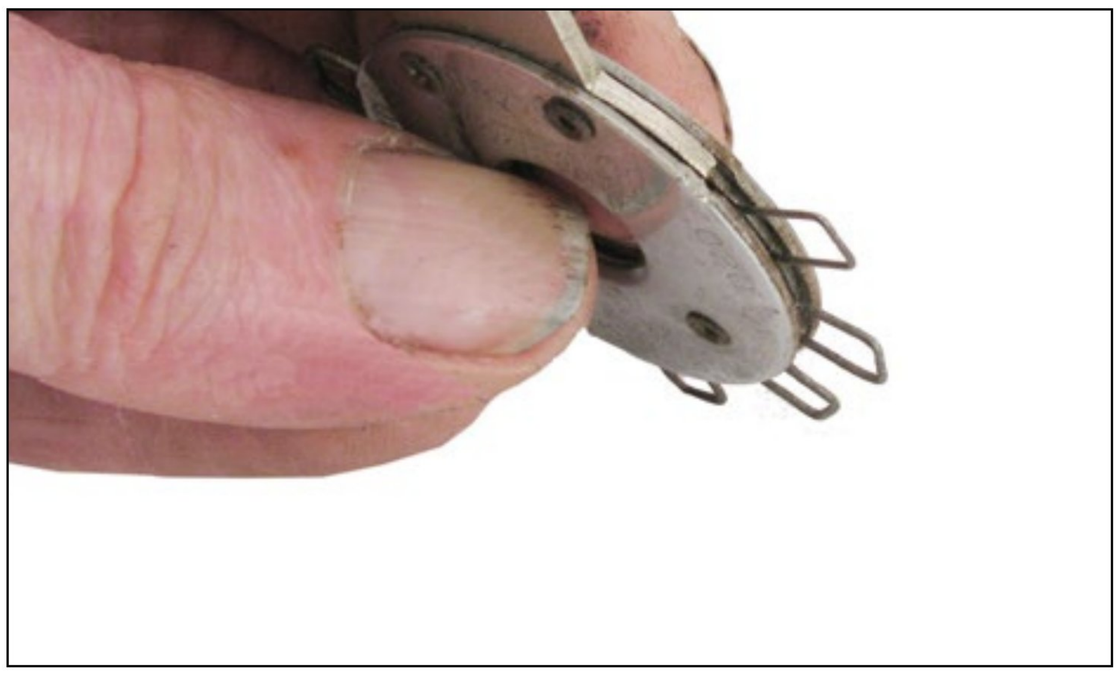

Figure 7—.020″ wire gauge

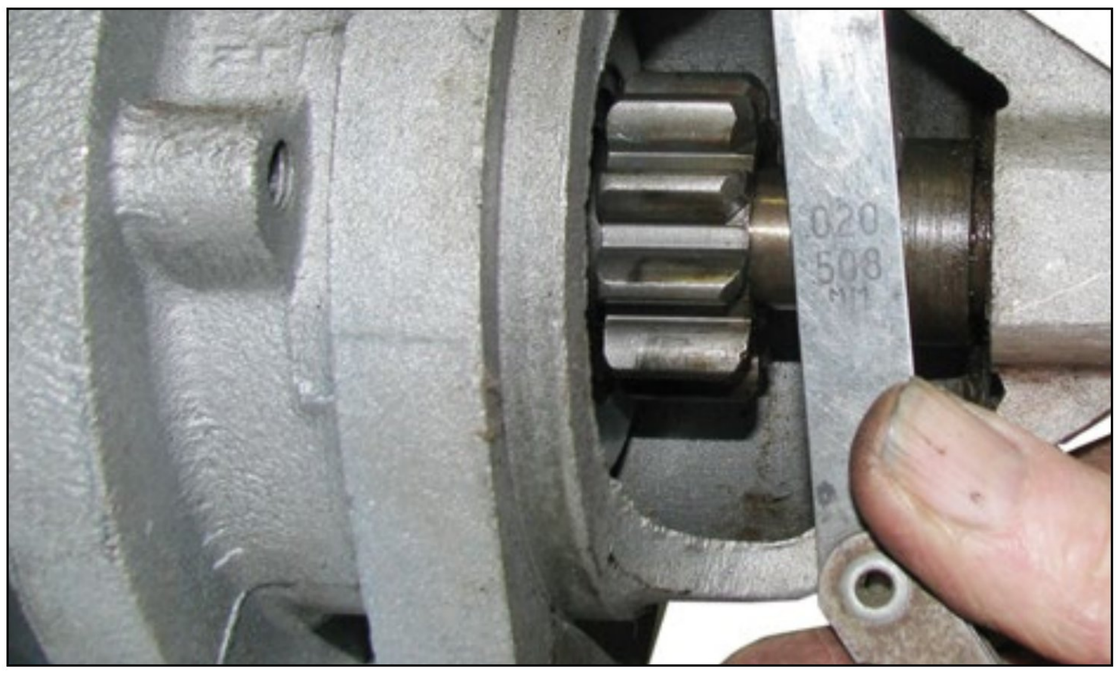

Figure 8—.020″ feeler gauge

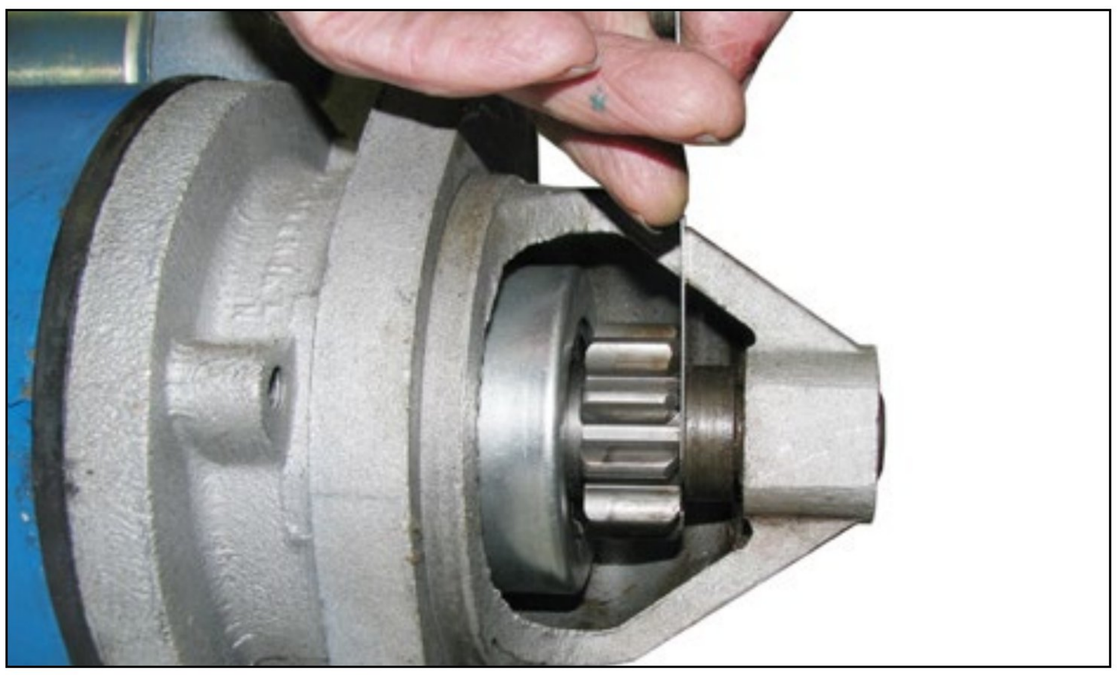

Figure 9—A feeler gauge is used to measure pinion clearance on Lucas M50 starter.



Figure 10—18 mm box-end wrench that has been ground down to fit around the jam nut.

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Jon Braun (Viking Auto Electric) watches a BPS employee wind rotor bobbins.



The ERA Theater showed training videos to a full-house during the show.



Level Seven's Matt Pagni discusses software solutions with Gail and Kenny Turner of C. C. Battery.



Dave Kaplan (seated) looks on as Gene Kaiser and Kevin Stone discuss Regitar USA's products with attendees.



Dan Bell (Apptrak Computer Software) presents a seminar about "Understanding Batteries" to a full house.



This year's reception served up Chicago-style pizza, which was universally acclaimed as the choice for future receptions.

About t

"Great selection of presentations. All of the speakers were very informative. Not surprisingly, Mohammad Samii and Dan Marinucci were the highlights of the weekend for me. I picked up a lot of new information, visited with vendors, resolved some technical issues, met with old friends, and made a few new friends.

Overall, a good experience."
Dave Stieler
CARCO Auto Electric, Michigan

"Kudos for an outstanding show ..."
Robert Wagner
Wagner Alternators, California

"I'm glad I attended. The seminars were all good, especially the one about how to price units and custom rebuilds. It's important to talk to people who are walking in the same shoes and facing the same challenges and making a go of it. Thanks to all the organizers!"
Lonnie Reimer,
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he show

PRIZE WINNERS:

JIMCO TB-770 Test Bench: won by Laura Curtis of the Ryder Rebuild Center, Doraville, Ga., and accepted for her by John Kaiser, also of Ryder Rebuild Center

Transpo VRC2010 Regulator Tester: Lynn Gross, Churubusco Auto Electric, Churubusco, Ind.

ERA 32" Flat-screen TV: Leroy Smith, Leroy's Generators and Starters, Morristown, Tenn.

Level Seven—Dell Tablet: Gail Turner, C. C. Battery, Corpus Christi, Texas

Regitar USA Tools: Air Impact Driver: ASAP, St. Paul, Minn.; Battery Powered Impact Driver: Lawrence Limtiaco, Guam Electric Motor Services, Guam; AC-Delco Inspection Camera: Daren Roggentien, Roggentien Electric, Marengo, Iowa

Wagner T-1800C COM Regulator Tester: Glen McLaughlin, Alt-Str Service, Myrtle Beach, S. C.

WAI-Global $50 Gift Cards: Brenda Anderson, Starline Rebuilders, Rockford, Ill.; Kane McGarity, McGarity Starter & Alternator Repair, Toccoa, Ga.; Chris Tompkins, Proline Distributors, Fairmont, W.V.



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Rebuilders picking up their name badges were greeted by the smiling Schroeder gals—Stephanie and Michele.



The pre-exhibition reception was packed with exhibitors and rebuilders enjoying pizza and each others company.



Raffle winner Lynn Gross (Churubusco Auto Electric) is presented with the VRC2010 tester by Bill Ernst (WAI-Global).



ERA President Hank Henke (right) congratulates TV winner Leroy Smith (Leroy's Generators and Starters).



Lawrence Limtiaco came all the way from Guam to attend the show and was rewarded by winning a prize from Regitar USA.



The outdoor patio and Friday's warm weather proved irresistible to many attendees who had endured a bitter, cold winter.

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STATOR

(Continued from page 1)

the insulators in the lamination stack (*see Figure 4*). After the stator cools, take a lead wire from one coil and clean it down to bare metal without scraping it. Scraping the insulation away will remove some of the copper, which may prevent you from getting the exact wire measurement. That could cause you to use the wrong wire size. Use a micrometer to measure the wire's diameter. To double check, measure the diameter in several locations along the lead wire. Then use an AWG chart to determine the wire size that you will need. Record the wire size on your drawn diagram. (The wire that I used for this job was 17 gauge.) For anyone who might not be aware, magnet wire is covered with a very thin layer of insulation coating. Although the wire may be referred to as being "enameled", the coating is not enamel paint. Polyurethane, polyamide, polyester and polyimide are the coatings most commonly used today. These coatings are flexible and resistant to breaking. You will find that it is actually quite difficult to scrape this insulation coating off the lead ends when the time comes. All magnet wires are rated by dielectric strength and maximum temperature limit. Wire manufacturers can tell you the diameter of the wire including the insulation. This can be valuable when the coil you are winding is confined to a given space, such as we have in the case of all stators.

Rule two—*The turn count must be correct.*

With the insulation burned away, it is relatively easy to unwind the wires from around each pole (*see Figure 5*). You must count the number of turns and record that number on your diagram. This stator had nine turns per pole.

Rule three—*The total length of each coil must be correct, and all coils (in this case two) must be equal in length.*

As you finish unwinding each pole, cut the old wire and measure it. On my unit, the section of wire wound around each pole was roughly three feet long. Twelve poles at 3 feet each means that you would need 36 feet of wire for each coil or 72 feet total for this stator. These coils were wound clockwise and counterclockwise alternatively. Record the winding pattern on your diagram.

The first step in the actual rewinding process is to prepare the lamination stack by cleaning it down to bare metal (*see Figure 6*). Once it is clean, you will have to make insulators for the slots. Here, we used thin 40MT starter insulators, available from DuBois Marketing (*see Figures 7 and 8*). It is extremely tough, flexible material, thin enough to maximize space for the wire. The top and the bottom surfaces of the lamination stack must also be insulated. We used a blue, two-part epoxy from International Epoxies, which is sold by Vensel Enterprises (*see Figure 9*). It is very durable and can be sanded once it cures, if you accidentally apply too much. The epoxies here are also used to hold the slot insulators in place. Allow the epoxy to fully cure before proceeding.

There are many sources online which provide magnet wire in all sizes. It is

(See STATOR, pg. 14)

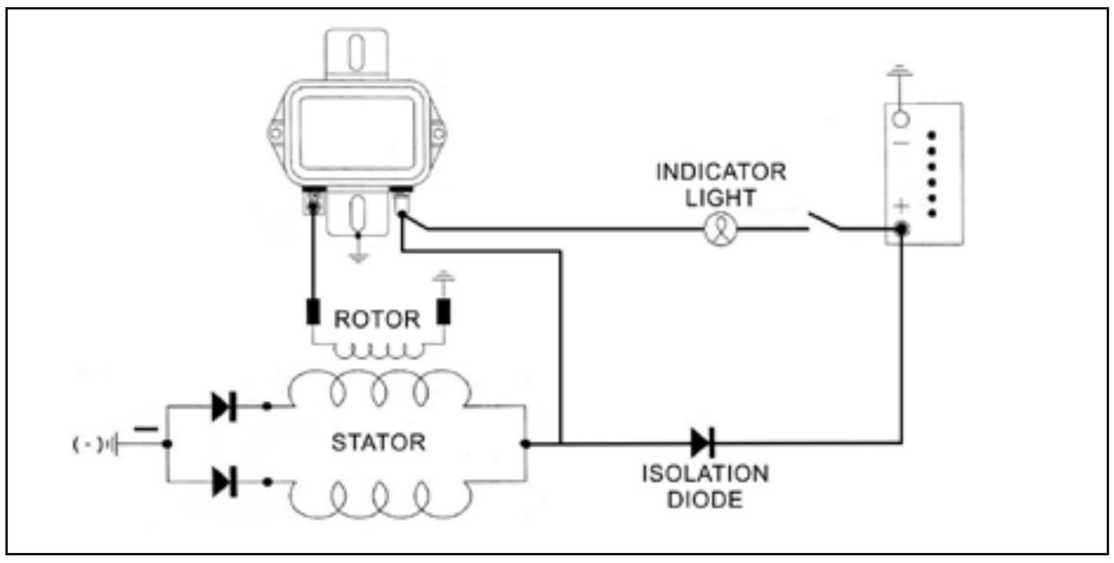

Figure 3—JIMCO wiring diagram of charging system circuit.

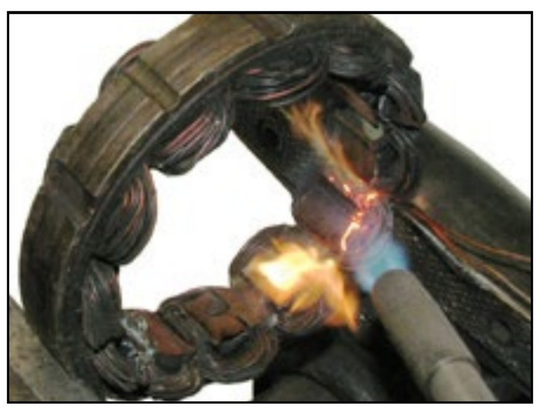

Figure 4—Using a MAPP gas torch, burn away all insulation.

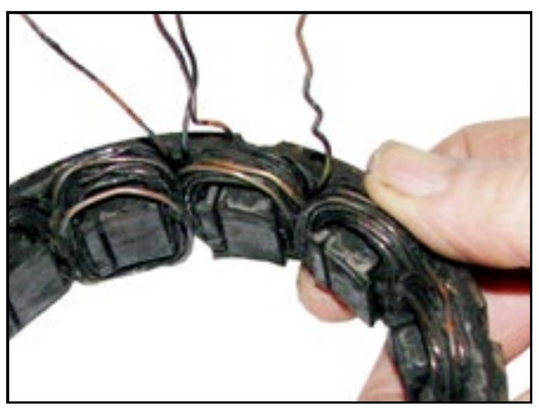

Figure 5—After the insulation is burned away, unwind the wire.

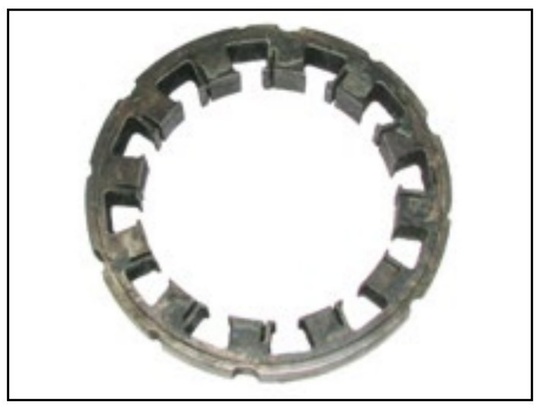

Figure 6—Bare metal and cleaned lamination stack.

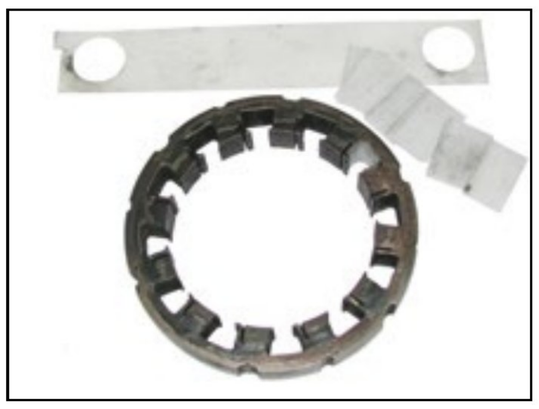

Figure 7—Lamination stack with insulators that have been cut from a 40MT insulator.

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PINION

(Continued from page 6)

quickly. If it becomes hot to the touch, let it cool off before proceeding. Once you have achieved the correct clearance, you must tighten the jam nut.

The difficulty here is preventing the pin from turning while tightening the jam nut. There is little room around the jam nut for anything but a thin-walled socket. But a socket covers the straight-slotted shift lever pin, making adjustment a trial-and-error process that can be very time consuming. We have taken an 18mm combination wrench and used a bench grinder to remove a significant amount of material surrounding the opening (*see Figure 10*). As you can see, this allows room to hold the adjustment pin securely in place while tightening the hex-headed jam nut (*see Figure 11*). Then we apply a small amount of penetrating locking compound to the threads to prevent the jam nut from loosening (*see Figure 12*).

The grinding away of metal, weakens the box-end of the wrench significantly, so it would be unwise to use this customized wrench to break loose a seized jam nut during the disassembly process. We use this particular wrench only for tightening the jam nut after the adjustment has been achieved.

When pinion clearance is greater than specified, there is a higher probability that milling will occur, because the pinion will be spinning faster than intended when it reaches the ring gear. Too much clearance also increases the solenoid release time. It can even cause a solenoid to stay engaged in an extreme case.

When pinion clearance is less than specified, there is a possibility that the contacts may not close tightly. This can cause arcing, voltage drops and sticking contacts. In any case, a starter in which pinion clearance has not been adjusted properly will most likely pass a free-spin bench test. The above described symptoms would not become apparent until after the starter was actually installed and used by a customer.

Many starters offer no form of adjustment, hence, there are no specifications for pinion clearance. This is possible because they were designed that way, with a wide pinion clearance window to allow for wear. This includes most of the Delco starters used on gasoline engines and some diesel engines up to the 27MT and early 30MT starters. However, due to excessive wear on shift levers and plungers, even these starters can experience the above-mentioned symptoms if pinion clearance drifts outside the designed window. Pinion clearance should always be "looked at" when testing any starter. As a general rule, when there is no specification, there should be some gap, and smaller is better. Shims can be added to Delco, Mitsubishi and some Hitachi solenoids to reduce pinion clearance if it is too great (*see Figure 13*).

Get into the habit of looking at pinion clearance every time you "final test" any rebuilt starter. It takes only a few seconds, and it may save you and your customers unnecessary warranty problems

ERA

PINION CLEARANCE CHART	
Lucas M50 and M126	.015"–.025"
Lucas M35G and M418G	.005"–.015"
Lucas M45G (roller clutch drive)	.005"–.015"
Lucas M45G (disk clutch drive)	.020"–.030"
Delco 37MT	.25mm–1.78mm
Delco 41MT	3.8mm–5.3mm
Delco 40MT, 42MT and 50MT	.031"–.360"

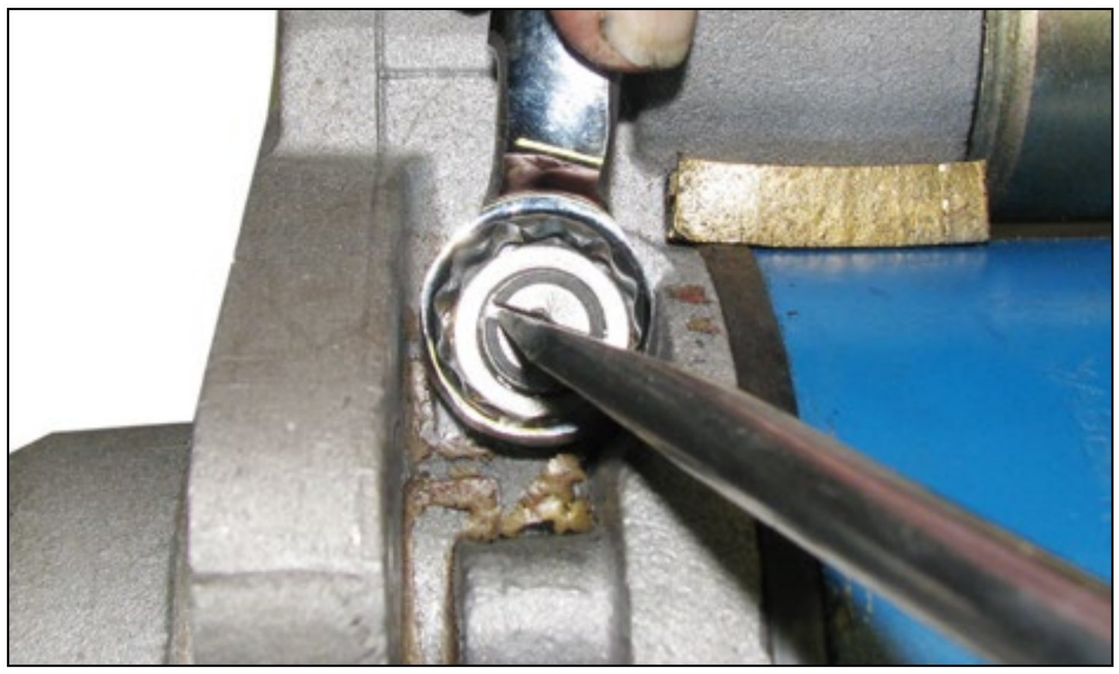

Figure 11—After correct pinion clearance has been achieved, tighten the jam nut while holding shift lever pin with slotted screwdriver.

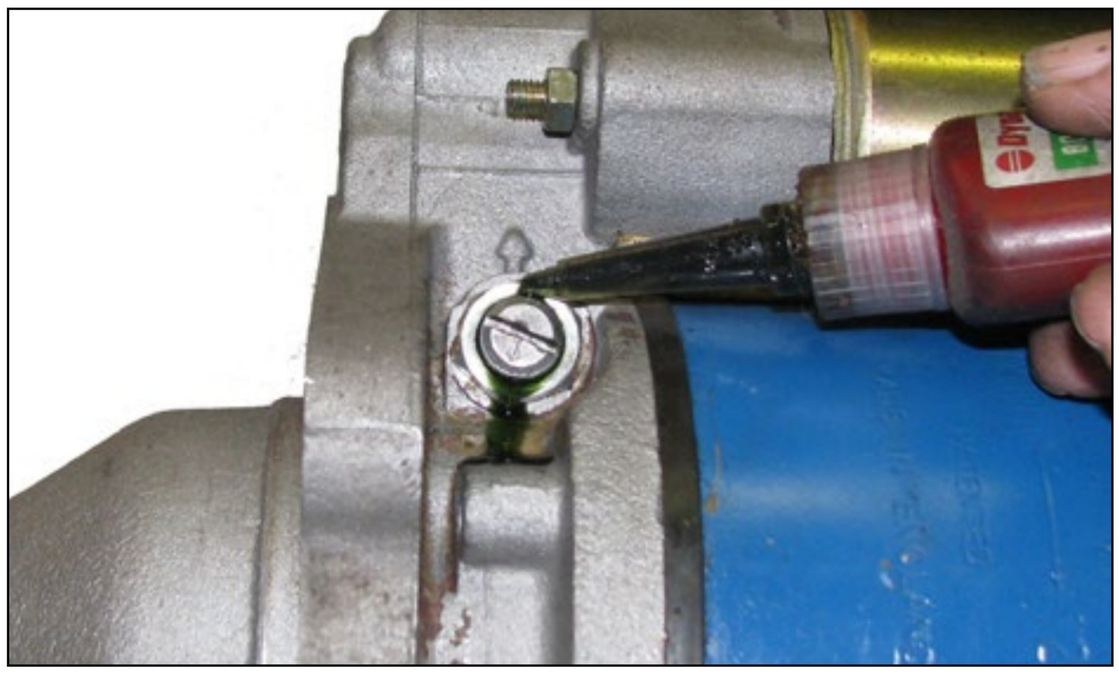

Figure 12—Apply thread locking compound.

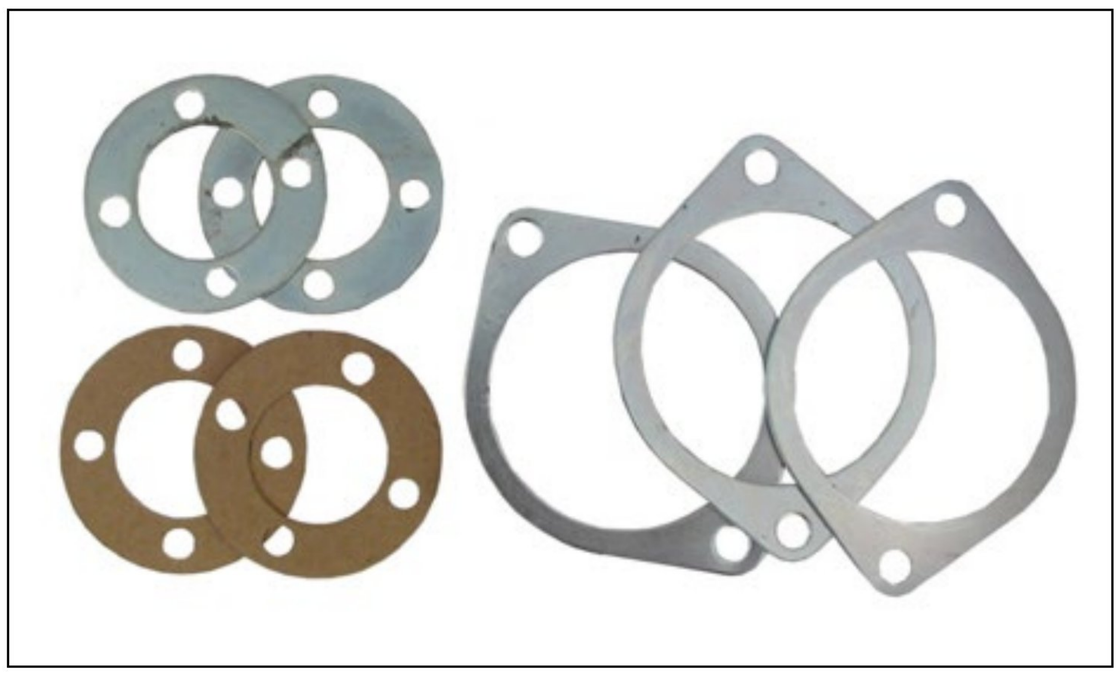

Figure 13—Mitsubishi and Delco solenoid shims can be used to adjust pinion clearance on these types of starters.

JIMCO congratulates Ryder Rebuild Center, the winner of our TB770 test bench, given away at the ERA Expo 2014 in Atlanta.

As always, we enjoyed visiting with old friends and making many new ones.

We look forward to seeing everyone next year!

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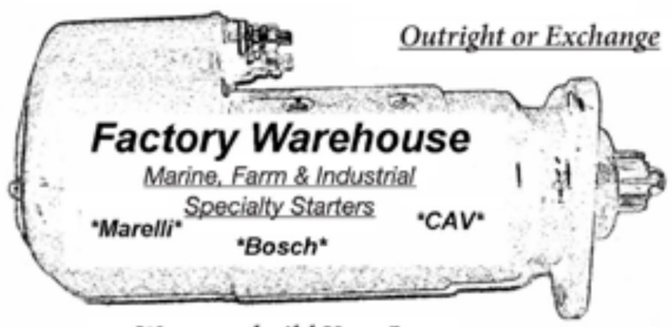

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Nippondenso DE Frame, fits Lester 11054, 11093… for Volvo… dim: 135mm OD

SHOW *(cont from page 5)*

Everyone was very friendly and willing to talk to me and answer my questions about the industry. The Exhibition was great, and I found some things that I needed. The seminars were the best, and I learned a lot. They were long, but so are some days at the shop, and I didn't go to the show to watch TV and rest! Thanks to everyone who made this EXPO happen and made it a great experience for me. Thanks."

Ben Boreson, Ben's Repair, Glasgow, Montana

"This ERA Show demonstrated that there is a future and a positive outlook in this business. I could really see the sincerity of the speakers and rebuilders in the sessions. It was a great experience to be around so many other rebuilders that want to win in this business. The seminars were not only encouraging, but they were also an extremely motivational experience. At this show, I saw a strong connective movement being created within this electrical rebuilding community. I look forward to next year's show!"

Lonnie Bain, Big Moe Starter and Alternator, San Antonio, Texas

ERA

Positive or Negative
Which ground is best?

BY BOB THOMAS

A few months ago, the ERA Help Line received a call asking why the once-common positive-ground electrical system had been totally abandoned by the automotive world. The caller, John Prinvale of John's Automotive Electrical in Quincy, CA, was asking, because a student in his high school auto shop class had asked him. I have to admit that I never gave this much thought before, although I had heard all kinds of rumors. He asked me about posting the question on the ERA Forums online, and I encouraged him to do so.

The question elicited 24 responses in less than a week, with many different theories as to why the system was no longer used. They included positive-ground's effects on corrosion of electrical connections, contact surface erosion, radio tubes, transistors and spark plugs. Over the course of a week, with help from ten of the forum's question-responders, I believe I have busted some myths, learned some science, and provided Prinvale with enough information to satisfy his inquisitive students. For anyone who may be interested, here is what I learned.

Positive Ground's Effects On:

Corrosion—Galvanic or bimetal corrosion takes place when dis-similar metals are in contact with each other while exposed to an electrolyte. The electrolyte could be moisture mixed with salt or other chemicals. When this happens, the less noble metal erodes much faster. Any current that might flow through a bimetal connection in a circuit in either direction, will not appreciably affect the galvanic corrosion that is already taking place. The direction in which a current flows does not have any effect on metal oxidation either—oxidation happens to metals when they are exposed to oxygen in the air. The presence of moisture accelerates oxidation, but it does not really cause it. The best way to prevent galvanic corrosion and oxidation is to seal out moisture and air using dielectric grease. For corrosion to take place, air or moisture must be present. Therefore, the grounding polarity of a circuit has little if any impact on the corrosion of the conductors in that circuit.

Contact Wear—The amount of surface material lost from arcing when a set of contacts opens, will be the same, in whichever direction the current flows. One contact will lose more material, depending on the direction of the current. If the current is reversed, you will still lose the same amount of surface material—just on the opposite side. The only exception to this is when the contacts are made of two different metals, such as generator regulator-relay contacts. Most of these relay contacts are made of two different materials to extend the wear-life. These regulators are manufactured specifically for only one polarity or the other. It is usually printed right on the regulator. Voltage regulators that can be used with either positive or negative ground, will have contacts made of the same material. This applies to all relays on any vehicle.

Electronics—Transistors and the radio tubes that preceded them, were manufactured to operate in only one type of system—either positive ground or negative ground, but not in both. Unless someone installs the wrong part, the ground polarity has no bearing on the cost or durability of these electronic devices.

Spark Plugs—As it turns out, polarity does matter when it comes to spark plugs. Regardless of a vehicle's polarity in relation to the battery, the secondary ignition system **has to be** positive ground. The spark plug was designed to emit negatively charged electrons from the center electrode at very high voltage. The side electrode must therefore be positively charged. This was difficult for me to grasp on a negatively grounded engine, but the high voltage secondary system does not necessarily have to be the same polarity as the rest of the vehicle. In essence, the secondary high voltage current is "its own world." Some ignition coils have been manufactured specifically for positive ground or for negative ground applications, while others will work either way, as long as the terminals marked "+" and "-" are connected correctly. Many coils could easily be hooked up backwards accidentally or as a prank. This would force the spark to jump backwards, from the side electrode to the center electrode. The effect of this on engine performance would be significant enough to cause hard starting and a lack of power. A backwards coil can easily be diagnosed on a scope, because the spark pattern will display upside down. When any vehicle is converted from positive to negative ground, the coil wires must be reversed, too. Even today's vehicles that use an individual coil pack for each cylinder, fire a positive ground spark!

So what really happened to positive ground? Why was it abandoned? We have negative ground today, not because it was necessarily better, but because of standardization. It was cost effective for the automotive industry to have all manufacturers use the same battery polarity. The Society of Automotive Engineers (SAE) tackled the problem in the 1950s, and they initiated an industry standard. Ford, General Motors and Chrysler were all "on board" within a few years. Not surprisingly, the last 6-volt systems were abandoned at about the same time, without the need for creating a standard. It had more to do with Ohm's Law.

Special thanks to Forum posters John Prinvale, Art Glass, Mohammad Samii, Juan Grube, Jerry Wine, Hank Henke, Lynn Gross, Bruce Schiroo, Morgan McDonald and Joe Davis (who called me).

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STATOR

(Continued from page 10)

sold in small rolls suitable for rewinding one stator. If you plan to rewind more than one stator, shop around for larger rolls. The roll used here was: 1 pound in weight, 158 feet long, 17 AWG, rated to 200 °C or 392 °F. Note that this is a little over twice the length that we calculated we would need. The price with shipping was under $20. We found the source on eBay—a company called Tech Fixx, located in Pittsburgh, Pennsylvania.

The next step is to measure out the wire for both coils, allowing for extra wire. You can cut off what is left over, but you cannot splice it if you come up short. We cut our wire into 50-foot lengths and started winding where the two positive ends on the original stator were located (*see Figures 10 and 11*). Making all of the turns fit can be a real challenge. Do not use pliers or screw driver tips to bend or form the wire. They will cut into the insulation. Handmade hardwood tools can be custom formed quickly, using a bench grinder and a dowel rod. We used a short length of a pencil to help form the turns, while protecting the insulation (*see Figures 12 and 13*). Remember to reverse the winding direction every time you move to the next pole.

Once you have several poles wound, you can begin staking the slots. We used wood for this purpose and found Popsicle sticks to be a near-perfect fit (*see Figures 15 and 16*). You can pick up a bag of 100 sticks in any craft store. They are especially handy for mixing and applying epoxies. The sticks' rounded ends make it a little easier to get them started when inserting them. Occasionally, you may find that the turns of wire do not leave enough room for the stake. When this happens, you will find it difficult to compress the wire toward the back of the slot. You can use pliers as long as the jaws do not contact the wire. In our stator, we used slip-joint pliers for this purpose and used a Popsicle stick to protect the insulation (*see Figure 17*).

When you have finished winding and staking the stator (*see Figure 18*), you should scrape the insulation from all of the coil wire ends and test the stator. In this case, we measured amperage draw on each coil to ensure that they were balanced. Then we used a ground-fault high-voltage tester to be sure that the coils were insulated from each other and from ground.

The final step is to apply epoxy to the stakes and fasten them to the lamination stack and the wire. Dipping the stator in varnish and curing it in an oven can also serve the same purpose, if you have that available to you. Once that epoxy cures, you will have to sand off the excess. This can be done using a sanding wheel or drum on a die grinder or drill motor (*see Figure 19*). Take care that you do not scratch the insulation on the wire in your newly rewound stator.

ERA

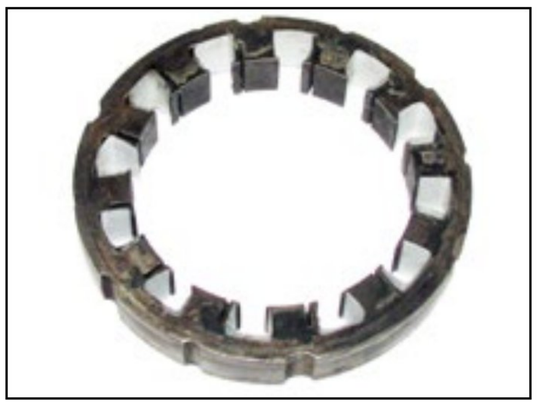

Figure 8— Lamination stack with all insulators in place.



Figure 9— Lamination stack with epoxy applied.

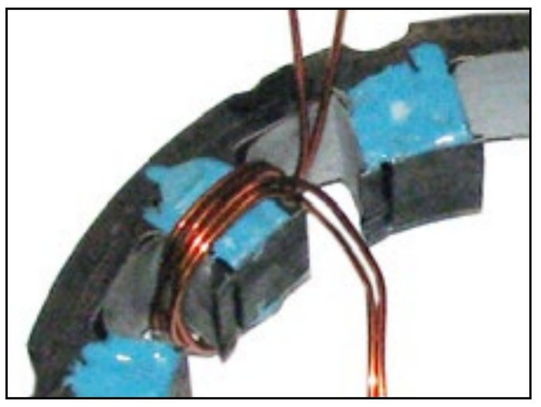

Figure 10— Begin winding the first pole

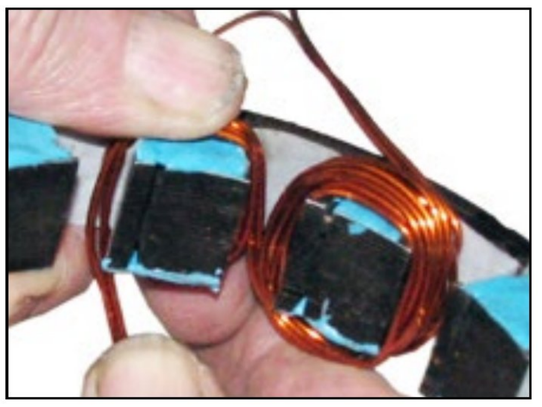

Figure 11— Reverse the direction of the turns for the second pole.

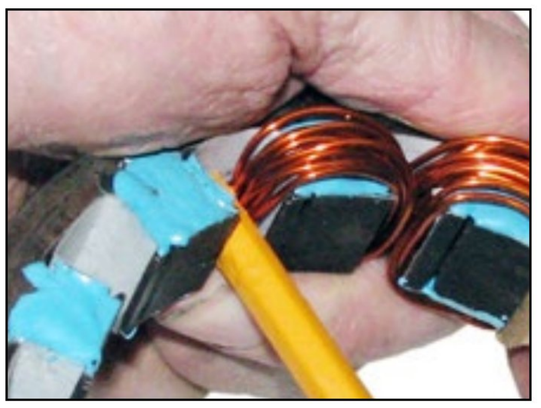

Figure 12— Use a pencil to help form the wire tightly around the poles.

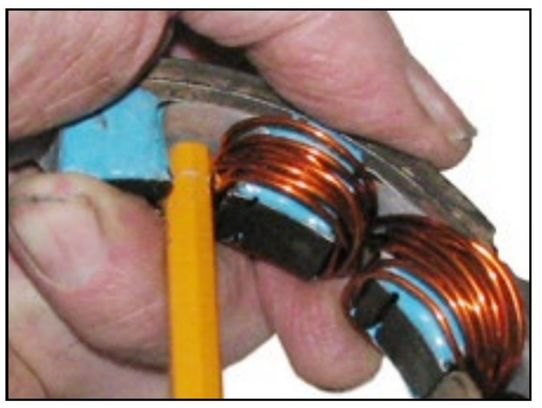

Figure 13— Keep the turns as tight as possible.

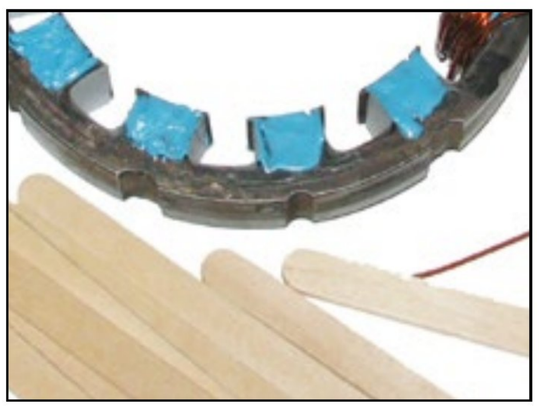

Figure 14— Popsicle sticks were just the right width.

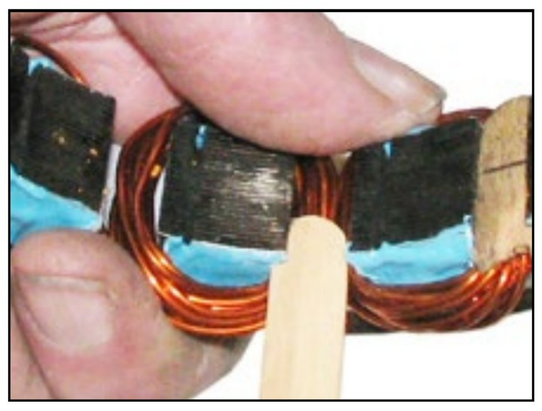

Figure 15— Stake the slot as you finish each pole to hold the turns in place.

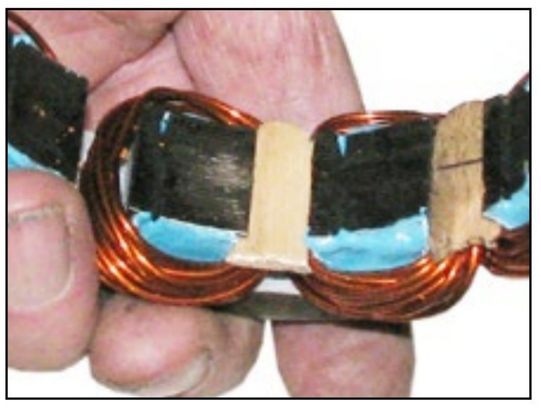

Figure 16— Each stake should be long enough to extend beyond the pole on each side.

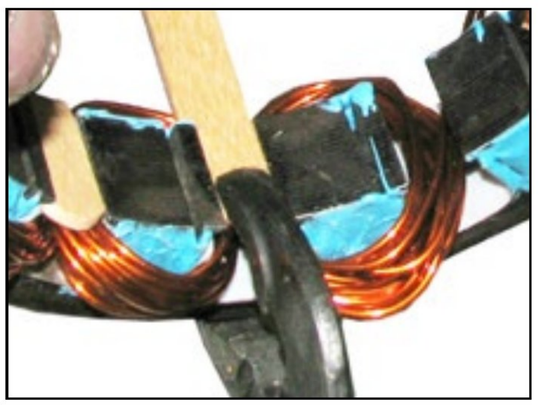

Figure 17— Use slip joint pliers to force wooden stake into the slot.



Figure 18— The winding is complete and the stator is ready for testing.

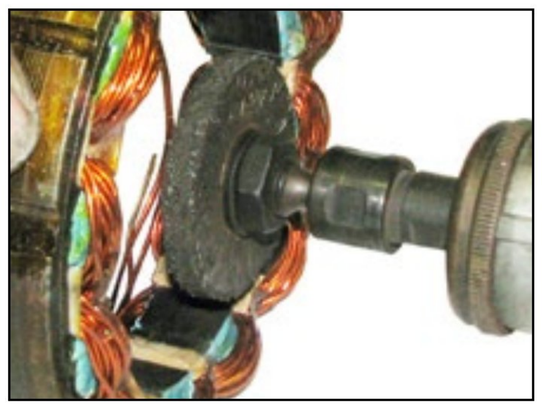

Figure 19— After applying epoxy use a sanding wheel to remove excess.

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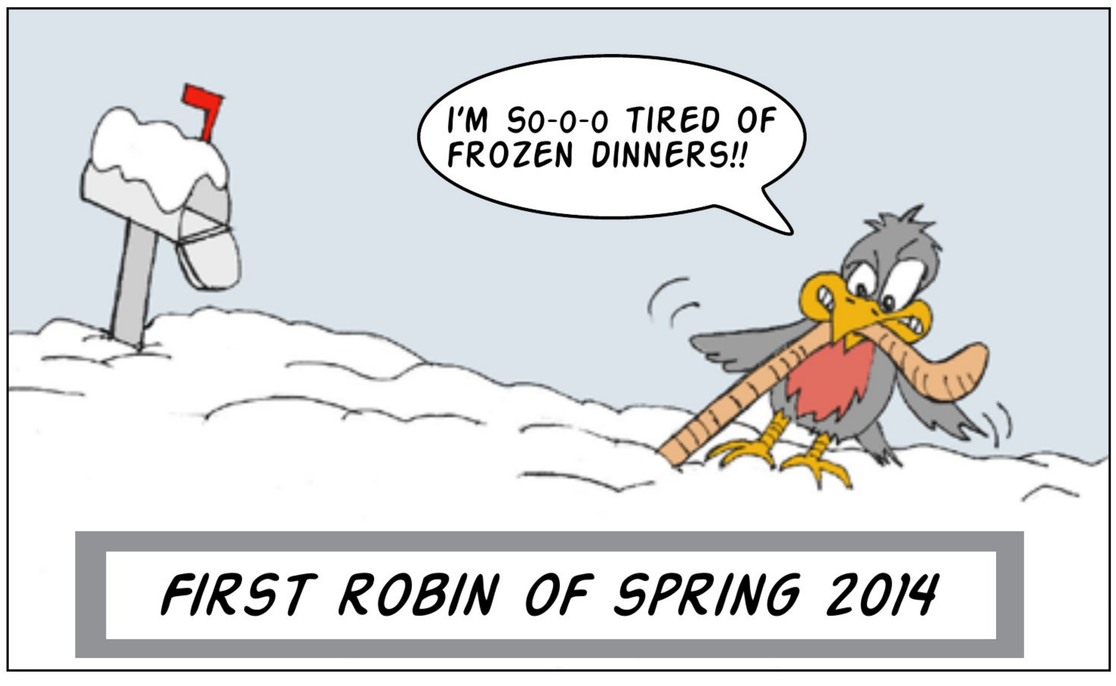
FIELD DAY—by Betsy Grueninger



SECRETS

(Continued from page 2)

to provide a platform for electrical rebuilders to exchange information with one another—hence the name: Electrical Rebuilder's Exchange. Even though the ownership of this paper has changed twice, the vision behind it has remained the same. From day one, many of the paper's readers, members of the rebuilding community, selflessly shared what they learned the hard way, what some might call their trade secrets.

Trade shows, like the ERA Expo held last month in Atlanta, provide a setting which is conducive to the sharing of information. Exhibitors bring new products to sell, but they also bring information to share with rebuilders. Seminars, panel discussions and roundtable forums disseminate an avalanche of information over a few days—enough information to last a whole year! But sometimes, the best source of new information at a trade show can be found in the lobby, the restaurant, the bar or the hallways of the hotel where the attendees are staying. It is the one-to-one communication between the rebuilders themselves, sharing their trade secrets with one another.

Today, there is only a handful of rebuilding businesses left in my area. But of those remaining, most still operate the same old way, in professional isolation. Sometimes, I wonder how they survive. There is only one other local rebuilder that I regularly see at industry events or trade shows. The others don't go, because I guess that they are afraid that they will give away their trade secrets. The really sad part is that they have no idea what they are missing. More importantly, what they are totally unaware of is what they could learn if they were only willing to participate. They must realize that times have changed, but still, they somehow believe that their survival depends upon protecting those trade secrets.

Rebuilding alternators and starters is no longer a simple occupation that can be learned on the job over a few weeks or months. It has evolved into a technical trade that requires basic electrical knowledge, mechanical skills, the willingness to work with your hands and the ability to solve problems. We have always been the specialists in our field, those who actually understand how electrical parts operate and how to fix them. Advances in electronics have opened opportunities for us to be even more specialized than ever before—provided that we have the willingness to break old habits and change our ways—provided that we are willing to share our experience with others—provided that we are willing share our own trade secrets.

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